

Flow Rate Sensor

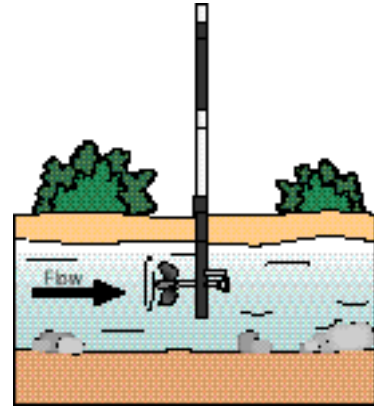
(Order Code NavFlo)

The Flow Rate Sensor measures the velocity of water in a river, stream, or canal. It can be used to study the discharge, flow patterns, and sediment transport of a stream or river.

Inventory of Items Included with the Flow Rate Sensor

Check to be sure that each of these items is included in your Flow Rate Sensor package:

- Flow Rate Sensor (impeller rod with 5 meter cable)
- Three riser rods (short, medium, and long)
- Flow Rate Sensor booklet



Collecting Data with the Flow Rate Sensor

Here is the general procedure to follow when using the Flow Rate Sensor:

1. Connect the Flow Rate Sensor to the LabNavigator.
2. The software will identify the Flow Rate Sensor and load a default data-collection setup. You are now ready to collect data.

Storage and Maintenance of the Flow Rate Sensor

When you have finished using the Flow Rate Sensor, simply rinse it with clean water and dry it using a paper towel or cloth. The probe can then be folded up and stored.

To prolong the life of your Flow Rate Sensor, we recommend that the moving parts of the impeller rod be lubricated with WD-40®, or a similar lubricant, after every few field uses.

When using the impeller rod, avoid hitting the impeller blade on rocks and other hard surfaces. If the impeller blade is bent, it will decrease the accuracy of the sensor.

This sensor is equipped with circuitry that supports auto-ID.

Specifications

Range	0 to 4.0 m/s (0 to 13 ft/s)
Resolution	0.0012 m/s
Accuracy	±1% of full-scale reading
Response time	98% of full-scale reading in 5 seconds, 100% of full-scale in 15 seconds
Temperature range (can be placed in)	0 to 70°C
Stored Calibration Values	
slope	1 m/s/V
intercept	0 m/s

How the Flow Rate Sensor Works

The Forston Labs Flow Rate Sensor measures the velocity of flowing water. When placed in a stream, as shown here, water flows against the blades of the impeller, causing it to turn. The faster the water flows, the faster the impeller turns. A bar magnet rotating with the impeller triggers a reed switch with each half rotation. The switch sends a pulse to the signal conditioning box, where the pulses are converted into a voltage that is proportional to flow rate. Flow rate can be measured in m/s or ft/s.

Do I Need to Calibrate the Flow Rate Sensor? No.

We feel that you should not have to perform a new calibration when using the Flow Rate Sensor. We have set the sensor to match our stored calibration before shipping it. You can simply use the appropriate calibration file that is stored in your data-collection program.

Uses of the Flow Rate Sensor

Calculating Discharge

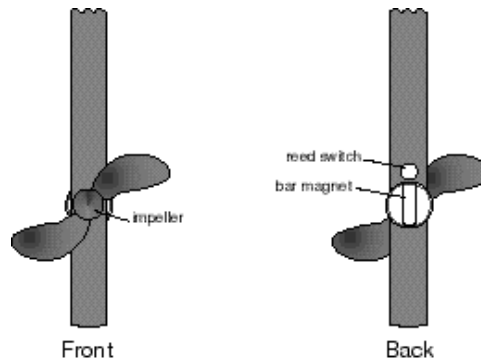
To determine the amount of water flowing in a stream, you need to measure the rate at which the water flows and the area the water occupies at a specific point in the stream. The discharge, or stream flow, is the flow rate multiplied by the area of water.

$$\text{Flow Rate} \times \text{Area of Cross Section} = \text{Discharge or Stream Flow}$$

Detailed instructions on collecting flow rate data and calculating discharge can be found in the next section of this booklet.

Sediment Transport

The amount of sediment and maximum particle size that can be transported by moving water is related to the flow velocity. Therefore, flow velocity data obtained using the Flow Rate Sensor can be used to



determine what size particles will stay in motion at a particular flow velocity. This chart, derived from accumulated observed data, shows that for a given flow velocity there is a range of behavioral possibilities for sediment particles lying on the bed, or entrained within the flow, of a stream. At a measured flow velocity of 1 m/s, silt and sand (though not compacted clay) will be eroded from the stream bed and transported downstream. At the same velocity, all sediment particles between 10 mm and 100 mm that were already in motion will continue in motion. Particles greater than 100 mm will be deposited. A Flow Rate Sensor can be a valuable observational tool when used in sediment transportation studies.

Site Selection

1. Select two sites within a 50 m stretch of the stream that are as far apart as possible and are representative of the stream as a whole. Avoid sites with bends or breaks in the stream caused by rocks or sandbars. Try to choose a site where some flow can be observed. One site can have a swift flow similar to that found in a riffle. The second site can have a moderate or slow flow like that found after a pool. It is not necessary for both sites to have identical flow.
2. At each site, you are going to take a cross section of the stream and measure its width and depth. Try to select a cross section that is shallow enough to measure depth with a meter stick and easy to cross. To measure stream flow using the Flow Rate Sensor, avoid sites where the stream depth is less than 10 cm.
3. The Flow Rate Sensor is equipped with a 5 m cable. This enables you to take measurements up to 4 meters away from the shore without carrying the interface out into the stream.
If the stream is wider than 4 meters, monitor the stream flow out from one shore line, then move to the other side of the stream. This should reduce the chances of dropping the equipment into the water and damaging it.
4. **Always follow safety precautions when entering the stream. If the water is too deep or swift, select another site.** Never venture out into the stream alone without another person available to assist you in case of emergency.

Testing Procedure

Measuring a Stream Cross Section

1. Using a measuring tape, determine the width of the stream cross section in meters and record the measurement on a data sheet. Divide the cross section into six equally spaced sections.

2. Using the meter stick, measure the depth of the stream in meters at each of the equally spaced points along the cross section. Record the depth and the distance out from one shore edge, in meters, on a data sheet. Always measure from the same shore. Be sure to include both the initial distance and depth and the final distance and depth.

Measuring Flow Velocity

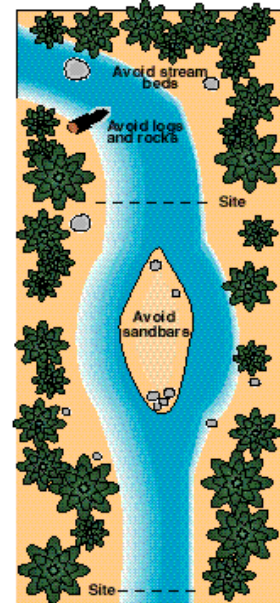
3. Plug the Flow Rate Sensor into the interface and start the data-collection program.

4. Collect stream flow data.

a. Set up the LabNavigator for single point data collection.

b. Submerge the impeller of the Flow Rate Sensor to about 40% of the depth measured at each section. If the section is shallow enough, use the plastic risers that are included with the flow rate sensor to support the sensor on the stream bed. The risers make it easier to keep the impeller in the same spot and oriented in the same direction.

c. Point the impeller of the sensor upstream (as shown below) and directly into the flow. Select **START** or **Collect** to begin sampling. Hold the sensor in place for 10 seconds while data are being collected. Once data collection is finished, the flow rate will be displayed. Record the reading on the Data & Calculations sheet. Repeat for each of the remaining sections.



Calculating Stream Flow

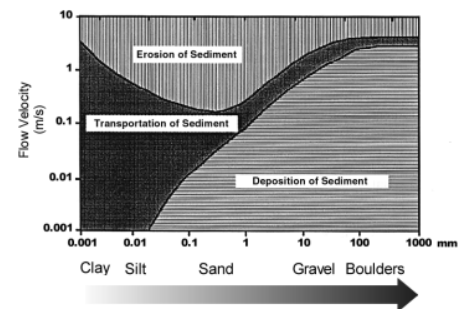
5. Create a graph of stream depth vs. distance from the shore.

6. Integrate the data. The integral value will give you the cross-sectional area of the stream.

Determining Discharge

7. Calculate the average velocity for each site.

8. To calculate the discharge or stream flow, multiply the average stream velocity by the cross-sectional area. Repeat for Site 2. To convert from m^3/s to cubic feet per second, multiply by 35.315.



Warranty

Forston Labs warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use.



Measure.Analyze.Record

Forston Labs

4098 Trouble Trail • Fort Collins, CO 80524
Toll Free (800) 301-1259 • (970) 237-4395 • FAX (970) 237-3347
info@forstonlabs.com • www.forstonlabs.com

Rev 2/01/10

LabNavigator, and other marks shown are our trademarks or registered trademarks in the United States.

All other marks not owned by us that appear herein are the property of their respective owners, who may or may not be affiliated with, connected to, or sponsored by us.